



Missouri Department of Natural Resources

Biological Assessment Report

Lower Big Creek Henry, Johnson, and Cass Counties

September 2004 – March 2005

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

Prepared by:

Missouri Department of Natural Resources
Field Services Division
Environmental Services Program
Water Quality Monitoring Section

Table of Contents

	Page
1.0 Introduction.....	1
2.0 Study Area	1
3.0 Site Descriptions	2
4.0 Methods	3
4.1 Macroinvertebrate Collection and Analysis.....	3
4.2 Physicochemical Data Collection and Analysis	3
4.3 Quality Assurance/Quality Control (QA/QC)	4
5.0 Data Results	4
5.1 Physiochemical Data.....	4
5.2 Habitat Assessment.....	6
5.3 Biological Assessment.....	7
5.3.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)	7
5.3.2 Comparisons of Big Creek with Regional Reference Streams in the Plains/Osage EDU	7
5.3.3 Lower Big Creek Longitudinal Comparison.....	8
5.3.4 Lower Big Creek Seasonal Comparison.....	8
5.3.5 Macroinvertebrate Percent and Community Composition	10
6.0 Discussion.....	10
7.0 Conclusions.....	10
8.0 Recommendations.....	11
9.0 Summary	11
10.0 References.....	12

Tables

	Page
Table 1 Percent Land Cover.....	2
Table 2 Big Creek Physical Characteristics of the Stations.....	4
Table 3 <i>In situ</i> Water Quality Measurements and Turbidity at all Big Creek Stations (Fall 2004).....	5
Table 4 <i>In situ</i> Water Quality Measurements and Turbidity at all Big Creek Stations (Spring 2005)	5
Table 5 Nutrient Concentrations at all Big Creek Stations (Fall 2004)	6
Table 6 Nutrient Concentrations at all Big Creek Stations (Spring 2005).....	6
Table 7 Lower Big Creek and Control Stream Habitat Scores	6
Table 8 Biological Criteria for Warm Water Reference Streams in the Plains/Osage EDU, Fall Season.....	7
Table 9 Biological Criteria for Warm Water Reference Streams in the Plains/Osage EDU, Spring Season	7
Table 10 Metric Values and Stream Condition Indices for Lower Big Creek (Fall 2004).....	8
Table 11 Metric Values and Stream Condition Indices for Lower Big Creek (Spring 2005)	8
Table 12 Lower Big Creek Macroinvertebrate Composition.....	9

Attachments

Appendix A Big Creek Map
Appendix B Macroinvertebrate Bench Sheets

1.0 Introduction

At the request of the Water Protection Program (**WPP**), the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of Big Creek, which flows through a rural watershed primarily in Cass, Johnson, and Henry Counties, Missouri.

Sampling at Big Creek was conducted September 13-16, 2004 and March 28-30, 2005. Sampling was conducted by Brian Nodine and Carl Wakefield of ESP. During Fiscal Year (**FY**) 2004, WQMS staff conducted a study on upper Big Creek (MDNR 2004). This study concentrated on lower Big Creek between the communities of Pleasant Hill and Clinton, Missouri.

Three null hypotheses were tested for this study. The first was that macroinvertebrate communities would not differ significantly from macroinvertebrate communities in similar sized reaches of reference streams (see Table 1 for reference streams) within the Plains/Osage Ecological Drainage Unit (**EDU**). The second was that macroinvertebrate communities would not differ significantly between longitudinally separate reaches of lower Big Creek. And the third null hypothesis was that macroinvertebrate communities would not differ significantly between seasons.

2.0 Study Area

Big Creek originates in southern Jackson County just north of the city of Lake Winnebago and approximately two miles from the Jackson/Cass County line. It flows southeast through its watershed of rural pasture and cropland (Table 1) until its confluence with the Grand River in Henry County. According to Chapter 7 of the State of Missouri Water Quality Standards (10 CSR 20-7.031), the 4.3-mile section from sec. 20, T. 47 N., R. 31 W. to the Highway 150 crossing is designated class "C". Beneficial use designations are for "livestock and wildlife watering" and "protection of warm water aquatic life and human health-fish consumption". The 61.3-mile section from Highway 150 to the confluence with the Grand River is designated as a class "P" stream with the same beneficial uses. The lower 49 miles of Big Creek are listed by the Clean Water Commission under section 303(d) of the Clean Water Act for impairment due to sediment by nonpoint sources (**NPS**).

Big Creek and applicable reference streams are located within the Plains/Osage EDU. An EDU is a region where biological communities and habitat conditions can be expected to be similar. See Appendix A for a map of the EDUs and the 14-digit Hydrologic Units (**HU**) that contain the sampling reaches for Big Creek. See Table 1 for a comparison of land use for the EDU and the 14-digit HUs. Land cover data were derived from Thematic Mapper satellite data from 1991-1993 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**).

Table 1
Percent Land Cover

	14-digit HU	Urban	Cropland	Grassland	Forest	Swamp
Plains/Osage EDU		0.2	23	54.9	17.9	0.3
Big Creek 1 & 2	10290108160002	0	30.7	49.2	17.3	0
Big Creek 3 & 4	10290108160001	0	31.7	54.8	12	0
Big Creek 5 & 6	10290108060004	0.6	35.5	47.4	14.6	0
Reference Streams						
E. Fork Crooked R.	10300101140007	0.1	67.1	22.3	8.5	0
Little Drywood Cr.	10290104060001	0	19.1	60.9	18.8	0
Little Drywood Cr.	10290104060003	1.3	13.9	62.7	19.7	0
Little Drywood Cr.	10290104060002	0.2	16.2	64.2	20	0

3.0 Site Descriptions

Six sampling locations were selected for this study. Two stations were located in Cass, Johnson, and Henry Counties each (see map Appendix A). The average width and discharge measurements during both survey periods are given for each sampling station in Table 2 of the result section. All stations are within Class P segments.

With one exception (station # 4), all sample stations were typical of the Plains/Osage EDU with steep banks, clay/mud bottoms, considerable woody debris, and little if any rock or gravel substrate.

Big Creek Station #1 (SE ¼ SE ¼ sec. 16, T. 42 N., R. 27 W.) is located immediately upstream of the Highway 7 crossing in Henry County. Geographic coordinates at the downstream terminus of this station were Lat. 38.427913°, Long. -93.900995°.

Big Creek Station #2 (NE ¼ sec. 30, T. 43 N., R. 27 W.) is within Missouri Department of Conservation's (MDC) Urich Conservation Area in Henry County. Geographic coordinates at the downstream terminus of this station were Lat. 38.48910°, Long. -93.93834°.

Big Creek Station #3 (NW ¼ sec. 29, T. 44 N., R. 28 W.) is located immediately downstream of County Road NW 1531 crossing in Johnson County. Geographic coordinates at the upstream terminus of this station were Lat. 38.57933°, Long. -94.02979°. This station is in a channelized section of the stream.

Big Creek Station #4 (W sec. 35, T.45 N., R. 29W.) is located immediately upstream of County Road SW 1871st just south of Fenwick in Johnson County. Geographic coordinates at the downstream terminus of this station were Lat. 38.66132°, Long. -94.10593°. This station is unique among the lower Big Creek sample locations. It is more typical of a transitional Ozark/Prairie stream with rocky substrate and bank outcroppings. There was very little woody debris at this site in comparison with other stations in this study.

Big Creek Station #5 (E secs. 7/18, T. 45 N., R. 29 W.) is located south of Strasburg in Cass County. Geographic coordinates at the downstream terminus of this station were Lat. 38.71711°, Long. -94.16310°.

Big Creek Station #6 (SW ¼ sec. 36, T. 46 N., R. 30W) is located just upstream of Hoover Road crossing in Cass County. Geographic coordinates were Lat. 38.74824°, Long. -94.18987°.

4.0 Methods

4.1 Macroinvertebrate Collection and Analysis

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003a). Three standard habitats, non-flowing water with depositional substrate (**NF**), large woody debris (**SG**), and rootmat (**RM**) at the stream edge, were sampled at all locations. Because of the size and depth of lower Big Creek, a canoe was used to access sample habitats at the lower three stations in the fall and the lower five stations in the spring.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**).

Macroinvertebrate data were analyzed in three specific ways. First, Big Creek stations were compared to biological criteria for the Plains/Osage EDU. Second, a longitudinal comparison between the six Big Creek sites was performed. Finally, a comparison was made of Big Creek data between fall and spring sampling seasons.

4.2 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations for temperature (°C), dissolved oxygen concentration (mg/L), conductivity (µS/cm), and pH. These measurements followed Standard Operating Procedures MDNR-FSS-101 Field Measurement of Water Temperature (MDNR 1993), MDNR-WQMS-103 Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter (MDNR 2002b), MDNR-FSS-102 Field Analysis for Specific Conductance (MDNR 2000a), and MDNR-FSS-100 Field Analysis of Water Samples for pH (MDNR 2001a), respectively. Additionally, water samples were collected and returned to ESP's Chemical Analysis Section for analyses of chloride, total phosphorus, ammonia-N, nitrate + nitrite-N, and total Kjeldahl nitrogen (TKN). Turbidity (NTU) was analyzed by the WQMS.

Stream discharge in cubic feet per second (cfs) was measured during each survey period using a Marsh-McBirney Flo-Mate Model 2000. Discharge was calculated per the methods in Standard Operating Procedure MDNR-FSS-113, Flow Measurement in Open Channels (MDNR 2001b). Discharge was not measured at Station #2 due to lack of suitable conditions.

Stream habitat characteristics for each sampling station were measured during the fall 2004 survey period using a standardized assessment procedure as described for glide/pool habitat in the Stream Habitat Assessment Project Procedure (MDNR 2003b).

Physicochemical data were summarized and presented in tabular form for comparison among the three stations and between sample seasons on Big Creek.

4.3 Quality Assurance/Quality Control (QA/QC)

QA/QC procedures were followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a).

5.0 Data Results

5.1 Physicochemical Data

Physical characteristics of Big Creek are presented in Table 2. Average stream widths at Big Creek stations ranged from 29 feet at the most upstream station to 46 feet at the most downstream station.

Table 2
Big Creek Physical Characteristics of the Stations

Station		Fall 2003	Spring 2004
	Average Width (feet)	Flow (cfs)	Flow (cfs)
1	43	20.3	80.6
2	70	-	-
3	48	8.17	58.4
4	60	8.03	44.1
5	32	4.5	22.3
6	38	3.48	19

In situ water quality measurements and turbidity are summarized in Table 3 (fall 2004) and Table 4 (spring 2005). Mean temperatures at Big Creek stations were 23.2°C and 12.1°C in the fall 2004 and spring 2005 surveys, respectively.

Conductivity levels were consistent among stations and between seasons. Dissolved oxygen levels were consistent between stations within each season. Dissolved oxygen during the fall was measured just above the Water Quality Standards minimum concentration for warm-water and cool-water fisheries (5.0 mg/L) at three stations. The difference in dissolved oxygen levels between seasons is likely because of the seasonal difference in water temperatures and flows.

Table 3

In situ Water Quality Measurements and Turbidity at all Big Creek Stations (Fall 2004)

Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/l)	Cond. (µS/cm)	pH	Turb. (NTU)
1	22.7	5.08	422	7.33	55.2
2	23.5	5.75	412	7.58	43.9
3	24.2	7.2	528	7.89	22.6
4	25.8	9.17	422	8.19	28.7
5	23.3	7.59	467	7.93	33.0
6	19.9	5.94	547	7.79	38.7

Table 4

In situ Water Quality Measurements and Turbidity at all Big Creek Stations (Spring 2005)

Station	Parameter				
	Temp. (°C)	Diss. O ₂ (mg/l)	Cond. (µS/cm)	pH	Turb. (NTU)
1	9.2	10.9	586	7.8	14.8
2	10.2	10.6	431	8.2	45.3
3	11	12.1	507	8.2	12.2
4	13.8	12.5	405	8.5	11.1
5	13.4	11.8	530	8.3	7.2
6	14.8	13.2	547	8.5	12.6

Nutrient and chloride concentrations are presented in Table 5 (fall 2004) and Table 6 (spring 2005). Ammonia results were below detectable limits with the exception of Station 2 during the spring 2005 season where the level, although detectable, was below general warm-water fishery chronic criteria for total ammonia. Nitrate + nitrite concentrations were generally higher during the fall season and at Station 6 during each season where levels reached 0.46 mg/L during the fall. The higher nitrate + nitrate levels at Station 6 are possibly due to the wastewater treatment facility at Pleasant Hill just upstream. Total phosphorous levels were consistent between stations and seasons. Chloride levels were consistent between stations and seasons and well below chronic criteria for protection of aquatic life.

Table 5
Nutrient Concentrations at all Big Creek Stations (Fall 2004)

Station	Sample #	Parameter (mg/L)				
		NH ₃ -N	NO ₃ + NO ₂ -N	TKN	Total Phos.	Chloride
1	043424	<0.03	0.16	0.73	0.15	14.0
2	043425	<0.03	0.14	0.84	0.12	15.8
3	043425	<0.03	0.06	0.54	0.11	17.3
4	043426	<0.03	0.12	0.59	0.11	21.4
5	043427	<0.03	0.26	0.63	0.14	19.4
6	043428	<0.03	0.46	0.67	0.12	21.3

Table 6
Nutrient Concentrations at all Big Creek Stations (Spring 2005)

Station	Sample #	Parameter (mg/L)				
		NH ₃ -N	NO ₃ + NO ₂ -N	TKN	Total Phos.	Chloride
1	0502865	<0.03	0.02	0.42	0.09	18.5
2	0502866	0.1	0.01	0.96	0.15	16.2
3	0502867	<0.03	0.02	0.54	0.1	18.5
4	0502868	<0.03	<0.01	0.47	0.12	21.5
5	0502869	<0.03	0.06	0.43	0.1	27.6
6	0502870	<0.03	0.19	0.51	0.11	28.8

5.2 Habitat Assessment

Habitat assessment scores were recorded for each sampling station. Results are presented in Table 7. According to the project procedure guidance, the total score from the physical habitat assessment is expected to be at least 75% similar to the total score of the control site for a study site to support a similar biological community. All Big Creek stations had habitat scores that exceeded the aforementioned threshold of similarity. It was therefore inferred that based on habitat, the sites should support comparable biological communities.

Table 7
Lower Big Creek and Control Stream Habitat Scores (2004)

Control Stream	Habitat Score	Big Creek	Habitat Score	% of Control
Little Dry Wood Cr.	112	Station #1	126	112.5
		Station #2	119	106.2
		Station #3	116	103.6
		Station #4	147	131.2
		Station #5	110	98.2
		Station #6	101	90.2

5.3 Biological Assessment

5.3.1 Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)

The SMSBPP evaluation used biological criteria that were calculated from ESP's database of Biological Criteria for Wadeable and Perennial Streams within the Plains/Osage EDU as explained in Biological Criteria for Wadeable/Perennial Streams of Missouri (MDNR 2002a). These criteria are listed for fall and spring seasons in Tables 8 and 9, respectively. Macroinvertebrate Stream Condition Index (**MSCI**) scores of 20-16 qualify as fully sustaining, 14-10 are partially sustaining, and 8-4 are considered non-sustaining of aquatic life.

Table 8

Biological Criteria for Warm Water Reference Streams in the Plains/Osage EDU, Fall Season

	Score = 5	Score = 3	Score = 1
TR	>57	28-57	0-27
EPTT	>6	3-6	0-2
SDI	>2.86	1.43-2.86	0-1.42
BI	<7.63	7.63-8.82	8.83-10

Table 9

Biological Criteria for Warm Water Reference Streams in the Plains/Osage EDU, Spring Season

	Score = 5	Score = 3	Score = 1
TR	>50	25-50	0-24
EPTT	>8	4-8	0-3
SDI	>2.29	1.14-2.29	0-1.13
BI	<7.16	7.16-8.58	8.59-10

5.3.2 Comparisons of Big Creek with Regional Reference Streams in the Plains/Osage EDU

Macroinvertebrate Stream Condition Indices were calculated for Big Creek as derived from biological criteria from regional Plains/Osage EDU reference streams. The four metrics, total scores, and SCI sustainability rankings for Big Creek during fall 2004 and spring 2005 are presented in Tables 10 and 11, respectively. All stations during both seasons received a "fully sustainable" ranking with the exception of Station 1 during the spring season, which received a "partially sustainable" ranking. This sample, however, was very close to a higher total score and would have received a "fully sustainable" score if just one more EPT taxon were collected.

Table 10
Metric Values and Stream Condition Indices for Lower Big Creek (Fall 2004)

Station	Sample #	TR	EPTT	BI	SDI	T-Score	Sustainability
1	0418743	63	10	7.40	3.33	20	Full
2	0418744	67	12	7.16	3.30	20	Full
3	0418745	68	13	6.62	3.44	20	Full
4	0418746	67	13	6.50	3.64	20	Full
5	0418747	64	9	6.91	3.04	20	Full
6	0418748	68	11	6.88	3.12	20	Full

Table 11
Metric Values and Stream Condition Indices for Lower Big Creek (Spring 2005)

Station	Sample #	TR	EPTT	BI	SDI	T-Score	Sustainability
1	0503000	58	8	7.72	2.78	16	Full
2	0503001	55	7	6.05	2.60	18	Full
3	0503002	73	14	6.71	3.15	20	Full
4	0503003	67	11	6.70	3.07	20	Full
5	0503004	68	6	6.84	2.88	18	Full
6	0503005	75	8	6.97	3.33	18	Full

5.3.3 Lower Big Creek Longitudinal Comparison

There were no differences between MSCI scores and metrics longitudinally with all stations receiving an SCI of “fully sustainable”. All but one station in the spring (Station #1) received an MSCI score of either 18 or 20.

5.3.4 Lower Big Creek Seasonal Comparison

There were no substantial differences between MSCI scores between seasons. During the fall season, all stations received a total MSCI score of 20 and during the spring season MSCI total scores ranged from 16 to 20.

Table 12
Lower Big Creek Macroinvertebrate Composition

Season	Fall 2004						Spring 2005					
Station #	1	2	3	4	5	6	1	2	3	4	5	6
Taxa Richness	63	67	68	67	64	68	58	55	73	67	68	75
EPTT	10	12	13	13	9	11	8	7	14	11	6	8
% Ephemeroptera	15.1	15.4	12.0	19	36.6	9.6	5.9	41.3	22.3	13.7	10.9	6.9
% Plecoptera	0	0	0	0	0	0	0.1	0	0.1	0.1	0	0
% Trichoptera	11.3	12.2	9.5	3.0	1.0	0.5	1.3	0.1	0.9	1.3	2.1	1.2
Total EPT %	16.4	27.6	21.5	22.0	37.6	10.1	7.3	41.4	23.3	15.1	13.0	8.1
% Diptera	36.5	46.1	49.8	52.6	33.0	69.1	75.6	47.7	61.3	76.7	74.2	75.5
% Dominant Families												
Chironomidae	35.2	45.7	48.4	51.1	32.6	68.3	74.5	46.5	58.4	76.2	73.4	74.0
Palaemonidae	9.7						1.9					
Hydropsychidae	9.4											
Tubificidae	7.5	7.7					4.9				3.4	2.2
Heptageniidae	7.3	12.2		5.8	20.9		3.1	4.3	5.8	4.3	7.2	3.2
Polycentropidae		7.4										
Elmidae		7.4	10.9	8.2	17.7	9.2				1.8	5.0	6.4
Leptoceridae			6.9									
Baetidae			6.0	8.3		3.0		34.8	10.4	5.9		
Coenagrionidae			5.7		3.8	5.3						
Sphaeriidae				4.7								
Caenidae					11.0	4.0		1.7	5.6	2.2	2.4	2.1
Crangonyctidae							5.3		5.2			
Corixidae								2.3				

5.3.5 Macroinvertebrate Percent and Community Composition

Macroinvertebrate taxa richness, EPT taxa, and percent EPT relative abundance are presented in Table 12. These tables also present percent composition for the five dominant macroinvertebrate taxa at the six lower Big Creek sites. The percent of relative abundance data was averaged from the sum of the three macroinvertebrate habitats (depositional non-flow, woody debris, and rootmat) sampled at each station.

Diptera was the dominant order at all six sample stations during both seasons, except during the fall at Station 5 where Ephemeroptera slightly outnumbered Diptera. Chironomidae was the dominant family at all six stations during both seasons, especially during the spring at Stations 1, 4, 5, and 6. Baetidae was also well represented during the spring at Station 2. Taxa richness and total EPTT scores were consistent between stations and seasons with the most noticeable exception being at Station 2 where taxa richness dropped from 67 to 55 between fall and spring and EPTT dropped from 12 to seven.

6.0 Discussion

Physicochemical results reveal few definitive trends other than typical seasonal differences.

Macroinvertebrate data do not reveal any notable impairment in lower Big Creek and tend to indicate a healthy community for its EDU.

Habitat assessments also do not reveal any impairment in lower Big Creek. Big Creek is typical of streams in the Plains/Osage EDU with mostly steep banks and soft substrates littered with woody debris, with the portion that runs through Station 4 being the exception. The section of Big Creek at Station 4 is more typical of an Ozark/Prairie transitional stream with rocky banks and substrate and less woody debris. Along most of the sampling reaches, with some exception, banks and riparian zones appeared predominantly well managed, which should limit the quantity of sediment runoff entering the stream if consistent throughout its entire length.

The study of upper Big Creek conducted by WQMS staff the previous fiscal year determined only minor impairment. All three stations sampled received a fully sustainable SCI rating except one station during the fall. That station was slightly impaired and received a partially sustainable SCI rating.

7.0 Conclusions

Based on this study, there can be no conclusion drawn that lower Big Creek is biologically impaired by sediment.

8.0 Recommendations

Because no impairment was revealed by this study and lower Big Creek appears to be maintaining a healthy macroinvertebrate community, it is recommended it be removed from the 303(d) list of impaired waters for impairment due to sediment.

9.0 Summary

1. The null hypothesis that macroinvertebrate assemblages will not differ substantially between lower Big Creek and reference streams in the same EDU is accepted.
2. The null hypothesis that macroinvertebrate assemblages will not differ between longitudinally separate reaches of lower Big Creek is accepted.
3. The null hypothesis that macroinvertebrate assemblages will not differ between seasons in lower Big Creek is accepted.

10.0 References

Missouri Department of Natural Resources. 1993. Field Measurement of Water Temperature. MDNR-FSS-101. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 2 pp.

Missouri Department of Natural Resources. 2000a. Field Analysis for Specific Conductance. MDNR-FSS-102. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 15 pp.

Missouri Department of Natural Resources. 2000b. Title 10. Rules of Department of Natural Resources Division 20-Clean Water Commission, Chapter 7-Water Quality. 10 CSR 20-7.031 Water Quality Standards. Missouri Department of Natural Resources, Water Pollution Control Program, P.O. Box 176, Jefferson City, Missouri 65102. pp. 10-136.

Missouri Department of Natural Resources. 2001a. Field Analysis of Water Samples for pH. MDNR-FSS-100. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 10 pp.

Missouri Department of Natural Resources. 2001b. Flow Measurement in Open Channels. Standard Operating Procedure MDNR-FSS-113. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 9 pp.

Missouri Department of Natural Resources. 2002a. Biological Criteria for Wadeable/Perennial Streams of Missouri. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 32 pp.

Missouri Department of Natural Resources. 2002b. Sample Collection and Field Analysis for Dissolved Oxygen Using a Membrane Electrode Meter. MDNR-FSS-103. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 13 pp.

Missouri Department of Natural Resources. 2003a. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. MDNR-FSS-030. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 24 pp.

Missouri Department of Natural Resources. 2003b. Stream Habitat Assessment Project Procedure. MDNR-FSS-032. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 40 pp.

Missouri Department of Natural Resources. 2004. Biological Assessment Report, Big Creek, Cass County, Missouri. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 17 pp.

Submitted by:

Brian L. Nodine
Environmental Specialist III
Environmental Services Program
Water Quality Monitoring Section

Date:

Approved by:

Connie Giesing
Interim Director
Environmental Services Program

CG:bnt

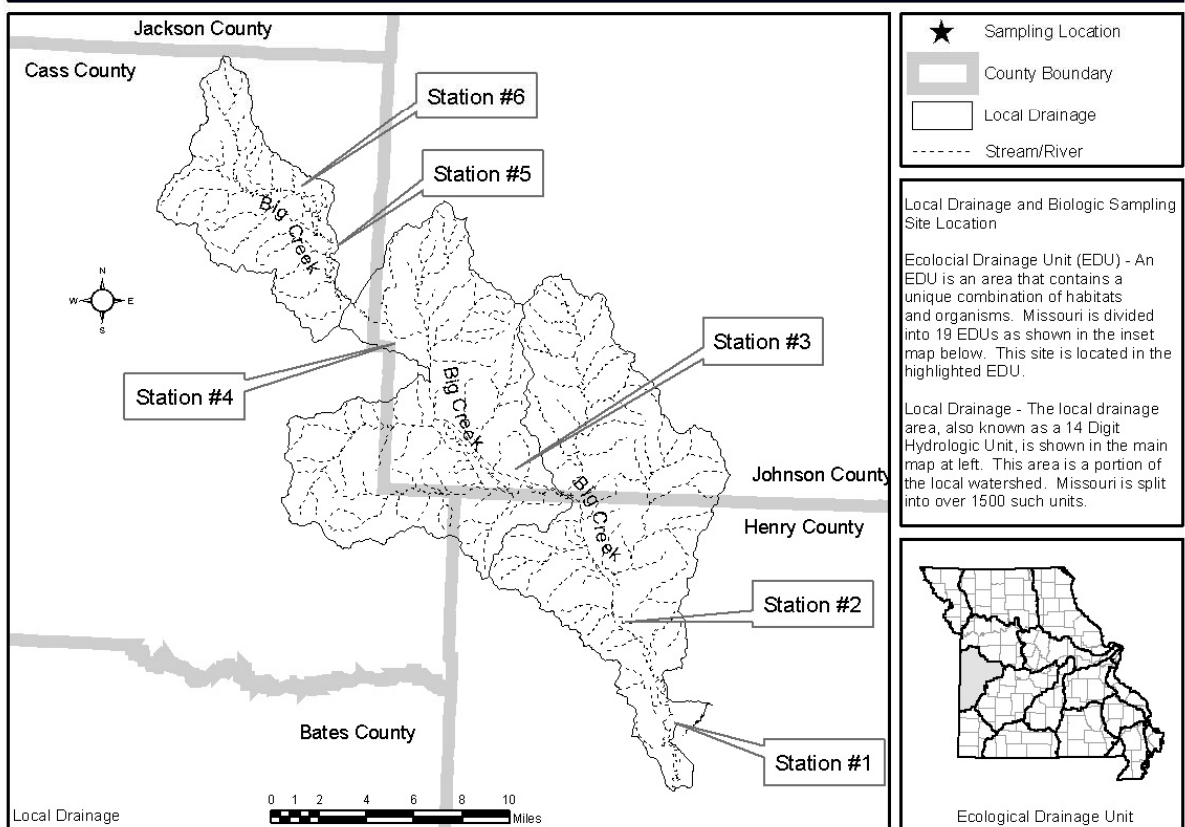
c: Karl Fett, Interim Regional Director, KCRO
John Ford, QAPP Project Manager, WPP

Appendix A

Map

Lower Big Creek
Plains/Osage EDU

Lower Big Creek



Appendix B

Macroinvertebrate Bench Sheets

Lower Big Creek Station #1
Fall 2004, Sample #0418743 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae		4	7	Planariidae
Tubificidae	40	1	11	Tubificidae
Branchiura sowerbyi	2	1	1	Tubificidae
Quistradrilus multisetosus	4	1	1	Tubificidae
Lirceus	4	15	17	Asellidae
Hyaella azteca	1		1	Hyaellidae
Crangonyx		20	13	Crangonyctidae
Palaemonetes	33	6	41	Palaemonidae
Orconectes virilis			-99	Cambaridae
Acerpenna			4	Baetidae
Baetis	1	9	2	Baetidae
Stenacron	36	22	2	Heptageniidae
Caenis latipennis	15		30	Caenidae
Caenis punctata			3	Caenidae
Argia	7	3	7	Coenagrionidae
Ischnura			20	Coenagrionidae
Arigomphus			-99	Gomphidae
Metrobates			1	Gerridae
Trepobates			2	Gerridae
Belostoma			-99	Belostomatidae
Ranatra			-99	Nepidae
Polycentropodidae	2	3		Polycentropodidae
Cheumatopsyche	2	60	15	Hydropsychidae
Leptocerus americanus			1	Leptoceridae
Nectopsyche			1	Leptoceridae
Oecetis	4		5	Leptoceridae
Dineutus			-99	Gyrinidae
Hydroporus			3	Dytiscidae
Thermonectus			1	Dytiscidae
Dubiraphia	1		15	Elmidae
Stenelmis			1	Elmidae
Climacia			2	Sisyridae
Ceratopogoninae	3			Ceratopogonidae
Ablabesmyia	4	5	8	Chironomidae
Harnischia	5		3	Chironomidae
Corynoneura	3			Chironomidae
Nanocladius		1	1	Chironomidae
Thienemanniella	2	6		Chironomidae
Axarus	2			Chironomidae
Cryptochironomus	2	1	1	Chironomidae
Dicrotendipes	1			Chironomidae
Glyptotendipes		1		Chironomidae

Lower Big Creek Station #1
Fall 2004, Sample #0418743 (2 of 2)

TAXON	NF	SG	RM	Family
Paralauterborniella	25		9	Chironomidae
Phaenopsectra	1			Chironomidae
Polypedilum halterale grp	2			Chironomidae
Polypedilum			1	Chironomidae
Polypedilum convictum		1	2	Chironomidae
Stenochironomus	4	17	1	Chironomidae
Polypedilum illinoense grp	5	2	2	Chironomidae
Polypedilum scalaenum	39	12	6	Chironomidae
Tribelos	2	29	1	Chironomidae
Rheotanytarsus	1	8	10	Chironomidae
Tanytarsus	8	8	29	Chironomidae
Hemerodromia	1	4	2	Empididae
Clinotanytus	1		1	Chironomidae
Thienemannimyia grp.	1	7		Chironomidae
Labrundinia	3		4	Chironomidae
Diptera	1			
Acarina	1			
Physella	1		1	Physidae
Menetus			5	Planorbidae
Ancylidae	1		1	Ancylidae
Sphaeriidae	4	-99	1	Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #2
Fall 2004, Sample #0418744 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae	1			Planariidae
Lumbricidae	3	1		Lumbricidae
Tubificidae	55	1	2	Tubificidae
Branchiura sowerbyi	11	3		Tubificidae
Limnodrilus hoffmeisteri	1			Tubificidae
Quistradrius multisetosus	3			Tubificidae
Lumbriculidae	1			Lumbriculidae
Glossiphoniidae	1		1	Glossiphoniidae
Palaemonetes	26		6	Palaemonidae
Orconectes virilis			-99	Cambaridae
Acerpenna		1		Baetidae
Baetis		1		Baetidae
Procladius	3			Baetidae
Stenacron	46	63	10	Heptageniidae
Stenonema femoratum		2		Heptageniidae
Tricorythodes			1	Leptohyphidae
Caenis latipennis	4	3	14	Caenidae
Hexagenia limbata	2	2		Ephemeridae
Argia	4	5	27	Coenagrionidae
Enallagma			2	Coenagrionidae
Nasiaeschna pentacantha			-99	Aeshnidae
Gerridae	1		3	Gerridae
Rheumatobates	1			Gerridae
Corixidae	2		1	Corixidae
Trichocorixa			1	Corixidae
Cyrnellus fraternus	24	48	1	Polycentropodidae
Cheumatopsyche		35	7	Hydropsychidae
Nectopsyche			4	Leptoceridae
Oecetis	1		1	Leptoceridae
Dineutus		-99		Gyrinidae
Berosus			1	Hydrophilidae
Scirtes			1	Scirtidae
Dubiraphia	1		37	Elmidae
Macronychus glabratus		3	2	Elmidae
Stenelmis		8	22	Elmidae
Anopheles			1	Culicidae
Ceratopogoninae		1		Ceratopogonidae
Ablabesmyia	29	13	28	Chironomidae
Harnischia	3	3		Chironomidae
Procladius	9	1		Chironomidae
Nanocladius	12	7	18	Chironomidae
Axarus			1	Chironomidae

Lower Big Creek Station #2
Fall 2004, Sample #0418744 (2 of 2)

TAXON	NF	SG	RM	Family
Cryptochironomus	6			Chironomidae
Dicrotendipes	3	5	1	Chironomidae
Stelechomyia	2	2		Chironomidae
Glyptotendipes	1	6		Chironomidae
Paralauterborniella	7			Chironomidae
Parachironomus			5	Chironomidae
Polypedilum halterale grp	1			Chironomidae
Polypedilum		1		Chironomidae
Polypedilum convictum			1	Chironomidae
Stenochironomus	6	30		Chironomidae
Polypedilum illinoense grp	9	2	14	Chironomidae
Polypedilum scalaenum	5	19	1	Chironomidae
Tribelos	16	25	2	Chironomidae
Pseudochironomus		1		Chironomidae
Paratanytarsus			2	Chironomidae
Rheotanytarsus		17	19	Chironomidae
Tanytarsus	4	29	57	Chironomidae
Hemerodromia		1		Empididae
Ephydriidae	1			Ephydriidae
Thienemannimyia grp.	5	10		Chironomidae
Labrundinia	4	2	6	Chironomidae
Acarina	1			
Physella			3	Physidae
Menetus			6	Planorbidae
Sphaeriidae	5	2	2	Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #3
Fall 2004, Sample #0418745 (1 of 2)

TAXON	NF	SG	RM	Family
Lumbricidae		1		Lumbricidae
Tubificidae	24			Tubificidae
Branchiura sowerbyi	16		1	Tubificidae
Piscicolidae	1			Piscicolidae
Hyalella azteca			1	Hyalellidae
Palaemonetes		-99	26	Palaemonidae
Orconectes luteus			-99	Cambaridae
Orconectes virilis	-99			Cambaridae
Acerpenna		38	2	Baetidae
Baetis		3		Baetidae
Callibaetis			3	Baetidae
Procladius	7	2	7	Baetidae
Stenacron	2	17	16	Heptageniidae
Stenonema femoratum	1			Heptageniidae
Tricorythodes		2	2	Leptohyphidae
Caenis latipennis	7		3	Caenidae
Hexagenia limbata	11	1		Ephemeridae
Argia	3		50	Coenagrionidae
Enallagma			6	Coenagrionidae
Gomphus	10		1	Gomphidae
Macromia	3		-99	Libellulidae
Rheumatobates			4	Gerridae
Cyrnellus fraternus		1		Polycentropodidae
Cernotina	2			Polycentropodidae
Cheumatopsyche		21	3	Hydropsychidae
Nectopsyche	16	1	54	Leptoceridae
Gyrinus		1		Gyrinidae
Berosus	1		8	Hydrophilidae
Dubiraphia	44		43	Elmidae
Macronychus glabratus		7	7	Elmidae
Stenelmis	8		4	Elmidae
Tipulidae			1	Tipulidae
Anopheles			1	Culicidae
Forcipomyiinae		6		Ceratopogonidae
Ceratopogoninae	3	1		Ceratopogonidae
Simulium	1			Simuliidae
Ablabesmyia	18	6	4	Chironomidae
Harnischia	5	3		Chironomidae
Nilotanytus		3		Chironomidae
Procladius	1	1		Chironomidae
Cricotopus/Orthocladius		4		Chironomidae
Nanocladius	2		6	Chironomidae

Lower Big Creek Station #3
Fall 2004, Sample #0418745 (2 of 2)

TAXON	NF	SG	RM	Family
Parakiefferiella			1	Chironomidae
Thienemanniella		6		Chironomidae
Cryptochironomus	8	1	1	Chironomidae
Dicrotendipes	2	10	8	Chironomidae
Stelechomyia		3		Chironomidae
Cryptotendipes	13	2		Chironomidae
Paracladopelma	1			Chironomidae
Paralauterborniella	2	1		Chironomidae
Polypedilum convictum		1	2	Chironomidae
Stenochironomus		14	1	Chironomidae
Polypedilum illinoense grp	12	20	23	Chironomidae
Polypedilum scalaenum	6	43		Chironomidae
Tribelos		14	1	Chironomidae
Pseudochironomus		6		Chironomidae
Cladotanytarsus	18	11		Chironomidae
Paratanytarsus			2	Chironomidae
Rheotanytarsus	1	15	1	Chironomidae
Stempellinella	9			Chironomidae
Stempellina	4			Chironomidae
Tanytarsus	15	64	74	Chironomidae
Hemerodromia		1		Empididae
Thienemannimyia grp.		17	7	Chironomidae
Labrundinia	1	1	3	Chironomidae
Physella			1	Physidae
Menetus			1	Planorbidae
Sphaeriidae	15		7	Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #4
Fall 2004, Sample #0418746 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae	2	7	12	Planariidae
Tubificidae		4	1	Tubificidae
Branchiura sowerbyi	1			Tubificidae
Glossiphoniidae	-99		-99	Glossiphoniidae
Hyaella azteca			4	Hyaellidae
Palaemonetes kadiakensis		1	1	Palaemonidae
Orconectes luteus	-99	1	1	Cambaridae
Acerpenna			41	Baetidae
Baetis		1	29	Baetidae
Proclleon	6	14		Baetidae
Stenacron	35	19	4	Heptageniidae
Stenonema femoratum	6			Heptageniidae
Tricorythodes		2	20	Leptohyphidae
Caenis latipennis	9	1	11	Caenidae
Hexagenia	7	2		Ephemeridae
Hetaerina			5	Calopterygidae
Argia	8	10	33	Coenagrionidae
Gomphidae	2			Gomphidae
Macromia	1			Libellulidae
Cynellus fraternus		3		Polycentropodidae
Ceratomyia	3	5	1	Polycentropodidae
Cheumatopsyche	1		12	Hydropsychidae
Hydroptila	3		4	Hydroptilidae
Nectopsyche			1	Leptoceridae
Berosus	3	4	14	Hydrophilidae
Helichus lithophilus			1	Dryopidae
Dubiraphia	10	5	33	Elmidae
Macronychus glabratus		21	3	Elmidae
Stenelmis	2	4	12	Elmidae
Forcipomyiinae		2		Ceratopogonidae
Simulium	2		12	Simuliidae
Ablabesmyia	15	8	4	Chironomidae
Harnischia	3	1		Chironomidae
Nilotanytus			2	Chironomidae
Cricotopus bicinctus		2	12	Chironomidae
Corynoneura		4	1	Chironomidae
Cricotopus/Orthocladius	3	4	24	Chironomidae
Nanocladius	6	1	1	Chironomidae
Thienemanniella	2	3	3	Chironomidae
Chironomus	1			Chironomidae
Cryptochironomus	2	1		Chironomidae
Dicrotendipes	7	14		Chironomidae

Lower Big Creek Station #4
Fall 2004, Sample #0418746 (2 of 2)

TAXON	NF	SG	RM	Family
Stelechomyia		1		Chironomidae
Cryptotendipes	4	1		Chironomidae
Paralauterborniella	5			Chironomidae
Phaenopsectra	1			Chironomidae
Polypedilum		3	5	Chironomidae
Polypedilum convictum grp	6	14	53	Chironomidae
Stenochironomus		24		Chironomidae
Polypedilum illinoense grp	4	6	18	Chironomidae
Polypedilum scalaenum	6	31		Chironomidae
Tribelos	2	38		Chironomidae
Pseudochironomus	3	32		Chironomidae
Cladotanytarsus	9	7		Chironomidae
Paratanytarsus	1		1	Chironomidae
Rheotanytarsus			24	Chironomidae
Stempellinella	10			Chironomidae
Stempellina	10	1		Chironomidae
Tanytarsus	32	54	13	Chironomidae
Thienemannimyia grp.	1	6	2	Chironomidae
Labrundinia			4	Chironomidae
Diptera	1			
Acarina		3	1	
Menetus			12	Planorbidae
Ancylidae	1			Ancylidae
Sphaeriidae	44		8	Sphaeriidae
Corbicula			-99	Corbiculidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #5
Fall 2004, Sample #0418747 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae		3		Planariidae
Branchiobdellida		2		
Tubificidae	15		7	Tubificidae
Branchiura sowerbyi	9		3	Tubificidae
Ilyodrilus templetoni	3		1	Tubificidae
Hyaella azteca			6	Hyaellidae
Crangonyx			5	Crangonyctidae
Palaemonetes kadiakensis	-99		3	Palaemonidae
Orconectes luteus	1			Cambaridae
Orconectes virilis	-99	-99	-99	Cambaridae
Acerpenna	3	8		Baetidae
Baetis	1	9		Baetidae
Proclleon		1		Baetidae
Stenacron	61	65	93	Heptageniidae
Tricorythodes	3	16	1	Leptohyphidae
Caenis latipennis	75	3	38	Caenidae
Hexagenia limbata	6			Ephemeridae
Argia	5	2	30	Coenagrionidae
Enallagma			3	Coenagrionidae
Dromogomphus	-99			Gomphidae
Gomphus	4		-99	Gomphidae
Gerris	1			Gerridae
Rheumatobates	1			Gerridae
Corixidae			1	Corixidae
Cheumatopsyche		4		Hydropsychidae
Nectopsyche	1		6	Leptoceridae
Berosus			2	Hydrophilidae
Dubiraphia	35	2	116	Elmidae
Macronychus glabratus		6	10	Elmidae
Stenelmis	6	2	9	Elmidae
Ceratopogoninae	2		3	Ceratopogonidae
Ablabesmyia	16	6	7	Chironomidae
Harnischia	2			Chironomidae
Nilotanypus		2		Chironomidae
Procladius	2			Chironomidae
Corynoneura	2	1	9	Chironomidae
Cricotopus/Orthocladius		1		Chironomidae
Nanocladius	1	1	6	Chironomidae
Parakiefferiella			1	Chironomidae
Thienemanniella	1	3		Chironomidae
Chironomus		1		Chironomidae
Cryptochironomus	5			Chironomidae

Lower Big Creek Station #5
Fall 2004, Sample #0418747 (2 of 2)

TAXON	NF	SG	RM	Family
Dicrotendipes		4		Chironomidae
Cryptotendipes	1			Chironomidae
Paralauterborniella	3	1	6	Chironomidae
Polypedilum		3		Chironomidae
Polypedilum convictum grp	4	37	7	Chironomidae
Polypedilum fallax grp	2	5		Chironomidae
Stenochironomus		11		Chironomidae
Polypedilum illinoense grp	1	16	21	Chironomidae
Polypedilum scalaenum	15	8	5	Chironomidae
Tribelos	2	4	2	Chironomidae
Pseudochironomus		2		Chironomidae
Cladotanytarsus	2	2		Chironomidae
Paratanytarsus			1	Chironomidae
Rheotanytarsus	2	5	12	Chironomidae
Tanytarsus	18	13	26	Chironomidae
Thienemannimyia grp.	6	10	4	Chironomidae
Labrundinia	3	1	9	Chironomidae
Acarina	1			
Physella	1			Physidae
Ancylidae	3		5	Ancylidae
Sphaeriidae	2	1		Sphaeriidae
Corbicula	-99			Corbiculidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #6
Fall 2004, Sample #0418748 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae			2	Planariidae
Tubificidae	6	3		Tubificidae
Glossiphoniidae			1	Glossiphoniidae
Caecidotea			1	Asellidae
Hyalella azteca			18	Hyalellidae
Crangonyx			8	Crangonyctidae
Palaemonetes kadiakensis		4		Palaemonidae
Orconectes virilis		-99		Cambaridae
Acerpenna		2	7	Baetidae
Baetis		7	21	Baetidae
Proclleon	2			Baetidae
Stenacron	1	12	12	Heptageniidae
Stenonema femoratum	1			Heptageniidae
Tricorythodes			3	Leptohyphidae
Caenis latipennis	24		27	Caenidae
Hexagenia limbata	3			Ephemeridae
Argia			53	Coenagrionidae
Enallagma			13	Coenagrionidae
Ischnura			1	Coenagrionidae
Gomphus	1			Gomphidae
Neoplea			1	Pleidae
Cheumatopsyche		2	1	Hydropsychidae
Hydroptila		2		Hydroptilidae
Nectopsyche			2	Leptoceridae
Berosus	1		1	Hydrophilidae
Scirtes			3	Scirtidae
Dubiraphia	39	5	33	Elmidae
Macronychus glabratus	3	7	15	Elmidae
Stenelmis	1		14	Elmidae
Tipula	1			Tipulidae
Anopheles			1	Culicidae
Dasyheleinae			1	Ceratopogonidae
Ceratopogoninae	3	1		Ceratopogonidae
Ablabesmyia	23	2	10	Chironomidae
Harnischia		4		Chironomidae
Nilotanypus			2	Chironomidae
Procladius	1	1		Chironomidae
Cricotopus bicinctus	1			Chironomidae
Corynoneura			2	Chironomidae
Cricotopus/Orthocladius	4	6	4	Chironomidae
Nanocladius	1	2	4	Chironomidae
Parakiefferiella			2	Chironomidae

Lower Big Creek Station #6
Fall 2004, Sample #0418748 (2 of 2)

TAXON	NF	SG	RM	Family
Thienemanniella	1		1	Chironomidae
Chironomus	6	2	1	Chironomidae
Cryptochironomus	5	2		Chironomidae
Dicrotendipes	24	33		Chironomidae
Cryptotendipes	3	3		Chironomidae
Paralauterborniella	9	3		Chironomidae
Microtendipes	1	2	3	Chironomidae
Polypedilum			1	Chironomidae
Polypedilum convictum grp	24	14	103	Chironomidae
Stenochironomus		4	1	Chironomidae
Polypedilum illinoense grp	2	4	30	Chironomidae
Polypedilum scalaenum	90	37	7	Chironomidae
Tribelos	1	6		Chironomidae
Pseudochironomus	1	34		Chironomidae
Cladotanytarsus	1	3	1	Chironomidae
Rheotanytarsus		9	65	Chironomidae
Stempellinella	1			Chironomidae
Tanytarsus	57	82	95	Chironomidae
Hemerodromia		3		Empididae
Ephydriidae	1			Ephydriidae
Thienemannimyia grp.		11	1	Chironomidae
Labrundinia	1		6	Chironomidae
Acarina	1			
Menetus			1	Planorbidae
Ancylidae	3			Ancylidae
Sphaeriidae	11	7	2	Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #1
Spring 2005, Sample #0503000 (1 of 2)

TAXON	NF	SG	RM	Family
Tubificidae	24		1	Tubificidae
Branchiura sowerbyi	1			Tubificidae
Limnodrilus cervix	1			Tubificidae
Limnodrilus hoffmeisteri	4			Tubificidae
Quistradrilus multisetosus	9			Tubificidae
Enchytraeidae	4	1		Enchytraeidae
Lirceus	4		6	Asellidae
Crangonyx	37	2	4	Crangonyctidae
Palaemonetes kadiakensis	7		9	Palaemonidae
Orconectes			-99	Cambaridae
Orconectes virilis	-99			Cambaridae
Acerpenna			10	Baetidae
Stenacron	16	3	4	Heptageniidae
Stenonema femoratum		1	1	Heptageniidae
Caenis latipennis	11			Caenidae
Hexagenia limbata	1	1		Ephemeridae
Argia		1		Coenagrionidae
Enallagma	1			Coenagrionidae
Leuctridae	1			Leuctridae
Ranatra nigra			2	Nepidae
Trichocorixa	3		3	Corixidae
Buenoa			-99	Notonectidae
Cheumatopsyche	2	3	5	Hydropsychidae
Ironoquia		1		Limnephilidae
Dineutus		-99		Gyrinidae
Berosus		1		Hydrophilidae
Enochrus		1		Hydrophilidae
Scirtes		1	3	Scirtidae
Dubiraphia	2			Elmidae
Ceratopogoninae	5		2	Ceratopogonidae
Simulium			1	Simuliidae
Ablabesmyia	8	3	3	Chironomidae
Gymnometriocnemus	1			Chironomidae
Procladius	1			Chironomidae
Corynoneura	6	1	6	Chironomidae
Cricotopus/Orthocladius	8	2	2	Chironomidae
Nanocladius	32	11	32	Chironomidae
Parakiefferiella	2			Chironomidae
Rheocricotopus	2		1	Chironomidae
Thienemanniella	8	6	6	Chironomidae
Chironomus	1			Chironomidae
Cryptochironomus	3			Chironomidae

Lower Big Creek Station #1
Spring 2005, Sample #0503000 (2 of 2)

TAXON	NF	SG	RM	Family
Dicrotendipes	1			Chironomidae
Glyptotendipes	4	1		Chironomidae
Paracladopelma	2			Chironomidae
Paralauterborniella	40	2		Chironomidae
Stenochironomus			1	Chironomidae
Polypedilum illinoense grp	4	167	68	Chironomidae
Polypedilum scalaenum	1	2		Chironomidae
Tribelos	4			Chironomidae
Paratanytarsus	2			Chironomidae
Rheotanytarsus	9	6	73	Chironomidae
Tanytarsus	12	6	38	Chironomidae
Hemerodromia	1			Empididae
Thienemannimyia grp.	5	6	2	Chironomidae
Acarina	1		1	
Ancylidae			1	Ancylidae
Sphaeriidae	1			Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #2
Spring 2005, Sample #0503001 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae			1	Planariidae
Lumbricidae	5			Lumbricidae
Tubificidae	11			Tubificidae
Enchytraeidae	2	1	2	Enchytraeidae
Erpobdellidae			1	Erpobdellidae
Hyaella azteca			4	Hyaellidae
Crangonyx			6	Crangonyctidae
Palaemonetes kadiakensis	1		5	Palaemonidae
Acerpenna	31	121	81	Baetidae
Stenacron	14	4		Heptageniidae
Stenonema femoratum	1	5	5	Heptageniidae
Caenis latipennis	12			Caenidae
Leptophlebia			-99	Leptophlebiidae
Hexagenia limbata	2			Ephemeridae
Ischnura			1	Coenagrionidae
Nasiaeschna pentacantha			-99	Aeshnidae
Gomphus	1			Gomphidae
Macromia	2			Libellulidae
Ranatra nigra			-99	Nepidae
Trichocorixa	2		14	Corixidae
Ironoquia			1	Limnephilidae
Neoporus		1	1	Dytiscidae
Enochrus			1	Hydrophilidae
Scirtes	1	1	2	Scirtidae
Dubiraphia	3			Elmidae
Ceratopogoninae	8			Ceratopogonidae
Ablabesmyia	16	2		Chironomidae
Harnischia	1			Chironomidae
Nilotanypus		1		Chironomidae
Cricotopus bicinctus	1	1	1	Chironomidae
Corynoneura	3	3	2	Chironomidae
Cricotopus/Orthocladius	1		3	Chironomidae
Nanocladius	1		2	Chironomidae
Parakiefferiella	3			Chironomidae
Hydrobaenus	3			Chironomidae
Thienemanniella	2	2		Chironomidae
Endochironomus	1	1		Chironomidae
Cryptochironomus	1			Chironomidae
Dicrotendipes	2	2		Chironomidae
Glyptotendipes			1	Chironomidae
Cryptotendipes	2			Chironomidae
Paralauterborniella	30			Chironomidae

Lower Big Creek Station #2
Spring 2005, Sample #0503001 (2 of 2)

TAXON	NF	SG	RM	Family
Phaenopsectra	1	2		Chironomidae
Polypedilum fallax grp		2		Chironomidae
Polypedilum illinoense grp	4	27	32	Chironomidae
Polypedilum scalaenum	1	1		Chironomidae
Tribelos	1			Chironomidae
Cladotanytarsus	1			Chironomidae
Paratanytarsus	6	1	4	Chironomidae
Rheotanytarsus	6	1	1	Chironomidae
Tanytarsus	85	7	11	Chironomidae
Zavrelimyia	1	1		Chironomidae
Thienemannimyia grp.	6	13	8	Chironomidae
Physella			2	Physidae
Sphaeriidae			1	Sphaeriidae

NF = Non-flow Habitat
 SG = Woody Debris (Snag) Habitat
 RM = Rootmat Habitat
 -99 = Present

Lower Big Creek Station #3
Spring 2005, Sample #0503002 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae			1	Planariidae
Tubificidae	1	1		Tubificidae
Branchiura sowerbyi	2			Tubificidae
Piscicolidae	1	1	1	Piscicolidae
Lirceus			17	Asellidae
Hyaella azteca	3		7	Hyaellidae
Crangonyx	5	1	48	Crangonyctidae
Palaemonetes kadiakensis	2	-99	7	Palaemonidae
Orconectes virilis			-99	Cambaridae
Acerpenna	7	26	75	Baetidae
Leucrocuta		1		Heptageniidae
Stenacron	2	29	21	Heptageniidae
Stenonema femoratum		3	4	Heptageniidae
Stenonema terminatum	1			Heptageniidae
Tricorythodes			1	Leptohyphidae
Caenis latipennis	40	3	15	Caenidae
Leptophlebia			1	Leptophlebiidae
Hexagenia limbata	2			Ephemeridae
Argia		1	1	Coenagrionidae
Enallagma			5	Coenagrionidae
Perlesta		2		Perlidae
Polycentropus	1			Polycentropodidae
Cheumatopsyche	1	1	2	Hydropsychidae
Ironoquia			1	Limnephilidae
Nectopsyche	3		1	Leptoceridae
Dineutus	-99	1		Gyrinidae
Peltodytes			1	Halipidae
Hydroporus	2	1	2	Dytiscidae
Berosus	7			Hydrophilidae
Scirtes		1		Scirtidae
Dubiraphia	12	3	3	Elmidae
Macronychus glabratus		1	2	Elmidae
Stenelmis	1			Elmidae
Ceratopogoninae	10	1	3	Ceratopogonidae
Simulium		2	7	Simuliidae
Ablabesmyia	6	2	2	Chironomidae
Larsia	1		1	Chironomidae
Nilotanytus			1	Chironomidae
Cricotopus bicinctus	1	5	4	Chironomidae
Corynoneura		9	5	Chironomidae
Cricotopus/Orthocladius	4	34	11	Chironomidae
Nanocladius	2	2		Chironomidae

Lower Big Creek Station #3
Spring 2005, Sample #0503002 (2 of 2)

TAXON	NF	SG	RM	Family
Parakiefferiella		5		Chironomidae
Hydrobaenus	5	3	1	Chironomidae
Thienemanniella		27	1	Chironomidae
Chironomus		1		Chironomidae
Cryptochironomus	1	3		Chironomidae
Dicrotendipes	2	6		Chironomidae
Cryptotendipes	12			Chironomidae
Paracladopelma	2			Chironomidae
Paralauterborniella	4			Chironomidae
Microtendipes		1		Chironomidae
Paratendipes	1			Chironomidae
Phaenopsectra			4	Chironomidae
Polypedilum convictum grp		5	3	Chironomidae
Polypedilum fallax grp		1	1	Chironomidae
Stenochironomus		4		Chironomidae
Polypedilum illinoense grp	8	34	35	Chironomidae
Polypedilum scalaenum		4		Chironomidae
Stictochironomus	1		2	Chironomidae
Tribelos		2		Chironomidae
Cladotanytarsus	8			Chironomidae
Paratanytarsus	12	2	20	Chironomidae
Rheotanytarsus	6	16	11	Chironomidae
Tanytarsus	183	38	20	Chironomidae
Hemerodromia		4		Empididae
Zavrelimyia			1	Chironomidae
Thienemannimyia grp.	1	7	9	Chironomidae
Labrundinia	2			Chironomidae
Diptera	2	1		
Acarina	1	2	2	
Physella			2	Physidae
Sphaeriidae	8			Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #4
Spring 2005, Sample #0503003 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae	1	3	2	Planariidae
Tubificidae	9		3	Tubificidae
Branchiura sowerbyi	5			Tubificidae
Enchytraeidae		9	2	Enchytraeidae
Erpobdellidae			-99	Erpobdellidae
Hyaella azteca		2	2	Hyaellidae
Palaemonetes kadiakensis			2	Palaemonidae
Orconectes luteus	-99			Cambaridae
Orconectes virilis			-99	Cambaridae
Acerpenna		5	56	Baetidae
Stenacron	15	16	7	Heptageniidae
Stenonema femoratum	6			Heptageniidae
Tricorythodes	4	2	7	Leptohyphidae
Caenis latipennis	16	3	4	Caenidae
Hetaerina			-99	Calopterygidae
Argia	3	1	4	Coenagrionidae
Enallagma			1	Coenagrionidae
Gomphus	-99			Gomphidae
Perlesta			2	Perlidae
Cheumatopsyche	3	3	6	Hydropsychidae
Hydropsyche			-99	Hydropsychidae
Hydroptila			1	Hydroptilidae
Ironoquia			-99	Limnephilidae
Triaenodes			1	Leptoceridae
Berosus	3		2	Hydrophilidae
Dubiraphia	3	2	5	Elmidae
Stenelmis	6		3	Elmidae
Ceratopogoninae	2			Ceratopogonidae
Simulium			1	Simuliidae
Ablabesmyia	9	5	2	Chironomidae
Harnischia	4			Chironomidae
Larsia	1			Chironomidae
Nilotanypus		1	8	Chironomidae
Cricotopus trifascia			1	Chironomidae
Cricotopus bicinctus			10	Chironomidae
Corynoneura	1	11	10	Chironomidae
Cricotopus/Orthocladius	19	101	88	Chironomidae
Eukiefferiella brevicealcar			13	Chironomidae
Nanocladius	12	9	21	Chironomidae
Hydrobaenus	6	2		Chironomidae
Thienemanniella	4	13	15	Chironomidae
Cryptochironomus	7			Chironomidae

Lower Big Creek Station #4
Spring 2005, Sample #0503003 (2 of 2)

TAXON	NF	SG	RM	Family
Dicrotendipes		3		Chironomidae
Cryptotendipes	1			Chironomidae
Paracladopelma	2			Chironomidae
Paralauterborniella	25			Chironomidae
Phaenopsectra		3		Chironomidae
Polypedilum convictum grp	3	6	20	Chironomidae
Polypedilum fallax grp		11		Chironomidae
Stenochironomus		2		Chironomidae
Polypedilum illinoense grp	11	11	40	Chironomidae
Polypedilum scalaenum		12		Chironomidae
Tribelos		2		Chironomidae
Pseudochironomus	4			Chironomidae
Cladotanytarsus	4			Chironomidae
Paratanytarsus	4	3	3	Chironomidae
Rheotanytarsus	1	6	30	Chironomidae
Tanytarsus	105	40	34	Chironomidae
Hemerodromia	1	1		Empididae
Zavrelimyia		1		Chironomidae
Thienemannimyia grp.	2	6	9	Chironomidae
Labrundinia	1		2	Chironomidae
Acarina	1			
Fossaria		2		Lymnaeidae
Physella			-99	Physidae
Menetus			1	Planorbidae
Sphaeriidae		2	2	Sphaeriidae

NF = Non-flow Habitat

SG = Woody Debris (Snag) Habitat

RM = Rootmat Habitat

-99 = Present

Lower Big Creek Station #5
Spring 2005, Sample #0503004 (1 of 2)

TAXON	NF	SG	RM	Family
Planariidae			2	Planariidae
Tubificidae	21			Tubificidae
Branchiura sowerbyi	12			Tubificidae
Limnodrilus claparedianus	1			Tubificidae
Enchytraeidae	2		1	Enchytraeidae
Erpobdellidae	-99		-99	Erpobdellidae
Lirceus	1		1	Asellidae
Hyaella azteca			4	Hyaellidae
Crangonyx	1		5	Crangonyctidae
Palaemonetes kadiakensis	2		8	Palaemonidae
Orconectes virilis	-99		-99	Cambaridae
Acerpenna			4	Baetidae
Stenacron	44	8	20	Heptageniidae
Tricorythodes	6		2	Leptohyphidae
Caenis latipennis	12		12	Caenidae
Hexagenia limbata	-99			Ephemeridae
Argia			5	Coenagrionidae
Ischnura			1	Coenagrionidae
Nasiaeschna pentacantha			1	Aeshnidae
Gomphus		-99		Gomphidae
Hagenius brevistylus	1			Gomphidae
Belostoma			-99	Belostomatidae
Trichocorixa	1			Corixidae
Cheumatopsyche	2	8	11	Hydropsychidae
Dineutus	-99		2	Gyrinidae
Peltodytes	1			Halipidae
Hydroporus	1			Dytiscidae
Dubiraphia	9		10	Elmidae
Macronychus glabratus	1		2	Elmidae
Stenelmis	24	2	2	Elmidae
Tipula			-99	Tipulidae
Chaoborus	1			Chaoboridae
Ceratopogoninae	2	1	3	Ceratopogonidae
Simulium		1		Simuliidae
Ablabesmyia	17		6	Chironomidae
Harnischia			1	Chironomidae
Larsia	1			Chironomidae
Nilotanytus		3	3	Chironomidae
Procladius	1			Chironomidae
Cricotopus bicinctus	1		4	Chironomidae
Corynoneura	1	2	6	Chironomidae
Cricotopus/Orthocladius	46	193	76	Chironomidae

Lower Big Creek Station #5
Spring 2005, Sample #0503004 (2 of 2)

TAXON	NF	SG	RM	Family
Eukiefferiella brevicar		1		Chironomidae
Nanocladius	4		19	Chironomidae
Hydrobaenus	10	1		Chironomidae
Thienemanniella	3	1	1	Chironomidae
Cryptochironomus	11	2		Chironomidae
Dicrotendipes		3		Chironomidae
Cryptotendipes	1			Chironomidae
Paracladopelma	1			Chironomidae
Paralauterborniella	5		9	Chironomidae
Kiefferulus		1		Chironomidae
Microtendipes			1	Chironomidae
Parachironomus	1			Chironomidae
Polypedilum convictum grp	12	30	19	Chironomidae
Polypedilum fallax grp		3	1	Chironomidae
Stenochironomus	2			Chironomidae
Polypedilum illinoense grp	5	2	45	Chironomidae
Polypedilum scalaenum		17		Chironomidae
Tribelos		1		Chironomidae
Paratanytarsus	1		8	Chironomidae
Rheotanytarsus	2	18	27	Chironomidae
Tanytarsus	26	6	25	Chironomidae
Zavrelimyia			1	Chironomidae
Thienemannimyia grp.	10	2	27	Chironomidae
Physella			-99	Physidae
Ancylidae		1		Ancylidae
Corbicula	1			Corbiculidae

NF = Non-flow Habitat
SG = Woody Debris (Snag) Habitat
RM = Rootmat Habitat
-99 = Present

Lower Big Creek Station #6
Spring 2005, Sample #0503005 (1of 2)

TAXON	NF	SG	RM	Family
Planariidae			1	Planariidae
Tubificidae	7	1		Tubificidae
Branchiura sowerbyi	3			Tubificidae
Ilyodrilus templetoni	1			Tubificidae
Limnodrilus cervix	2			Tubificidae
Limnodrilus hoffmeisteri	3		1	Tubificidae
Enchytraeidae	3	1		Enchytraeidae
Glossiphoniidae	1			Glossiphoniidae
Erpobdellidae	-99	-99		Erpobdellidae
Lirceus	3		3	Asellidae
Caecidotea (Blind &	1			Asellidae
Hyaella azteca			2	Hyaellidae
Crangonyx	1		12	Crangonyctidae
Palaemonetes kadiakensis		-99	2	Palaemonidae
Orconectes virilis	2		-99	Cambaridae
Acerpenna	1			Baetidae
Stenacron	2	11	13	Heptageniidae
Tricorythodes	9	1		Leptohyphidae
Caenis latipennis	8	3	6	Caenidae
Hexagenia limbata	1			Ephemeridae
Argia		1	1	Coenagrionidae
Enallagma	1		2	Coenagrionidae
Gomphus	1			Gomphidae
Belostoma			-99	Belostomatidae
Corixidae	2			Corixidae
Cheumatopsyche	7	1	1	Hydropsychidae
Hydroptilidae		1		Hydroptilidae
Isonychia			-99	Limnephilidae
Dineutus			-99	Gyrinidae
Hydroporus		2	4	Dytiscidae
Tropisternus			-99	Hydrophilidae
Dubiraphia	16	-99	16	Elmidae
Macronychus glabratus	1	9	3	Elmidae
Stenelmis	6	1	2	Elmidae
Ceratopogoninae	8	1		Ceratopogonidae
Simulium			1	Simuliidae
Ablabesmyia	20	1	4	Chironomidae
Harnischia	3	1		Chironomidae
Larsia			1	Chironomidae
Procladius	7			Chironomidae
Corynoneura			2	Chironomidae
Cricotopus/Orthocladius	50	35	66	Chironomidae

Lower Big Creek Station #6
Spring 2005, Sample #0503005 (2 of 2)

TAXON	NF	SG	RM	Family
Nanocladius	2	3	15	Chironomidae
Parakiefferiella		1		Chironomidae
Paraphaenocladus	1			Chironomidae
Hydrobaenus	10	4	2	Chironomidae
Thienemanniella		1	1	Chironomidae
Cryptochironomus	7	5	1	Chironomidae
Dicrotendipes	2	6		Chironomidae
Glyptotendipes		2		Chironomidae
Cryptotendipes	7			Chironomidae
Paracladopelma	2			Chironomidae
Paralauterborniella	28	6	8	Chironomidae
Microtendipes	3			Chironomidae
Paratendipes	2			Chironomidae
Phaenopsectra	3			Chironomidae
Polypedilum halterale grp	1			Chironomidae
Polypedilum convictum grp	4	1	3	Chironomidae
Polypedilum fallax grp	2	6		Chironomidae
Stenochironomus		13		Chironomidae
Polypedilum illinoense grp	2	6	23	Chironomidae
Polypedilum scalaenum		20	1	Chironomidae
Tribelos	2		1	Chironomidae
Pseudochironomus	7		1	Chironomidae
Paratanytarsus	4	1	3	Chironomidae
Rheotanytarsus	4	12	21	Chironomidae
Tanytarsus	20	60	19	Chironomidae
Hemerodromia	1			Empididae
Zavreliomyia			1	Chironomidae
Thienemannimyia grp.	3	17	11	Chironomidae
Labrundinia			4	Chironomidae
Diptera			1	
Fossaria	1			Lymnaeidae
Sphaeriidae	1	3	1	Sphaeriidae
Corbicula	4			Corbiculidae